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(54) Title: NOVEL SURFACTANT BLEND FOR USE IN HARD SURFACE CLEANING COMPOSITIONS

(57) Abstract

A cleaning composition containing: (a) from about 2 to about 5 % by weight of a sugar surfactant selected from the group consisting of an alkyl polyglycoside, a polyhydroxy fatty acid amide, and mixtures thereof; and (b) from about 1 to about 3 % by weight of an isopropylamine linear alkyl sulfonate, all weights being based on the weight of the composition.

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NOVEL SURFACTANT BLEND FOR USE IN HARD SURFACE CLEANING COMPOSITIONS

Field of the Invention:

The present invention generally relates to a novel hard surface cleaner. More particularly, the invention relates to a non-solvent degreasing composition used for removing oils and grease from hard surfaces.

Background of the Invention:

General purpose household cleaning compositions for hard surfaces such as metal, glass, ceramic, plastic and linoleum surfaces are commercially available in both powdered and liquid form. Powdered cleaning compositions consist mainly of builder or buffering salts such as phosphates, carbonates, and silicates and although such composition may display good inorganic soil removal, they suffer from the disadvantage of inferior cleaning performance on organic soils such as greasy/fatty/oily

soils.

Liquid cleaning compositions, on the other hand, have the great advantage that they can be applied to hard surfaces in neat or concentrated form so that a relatively high level of surfactant material is delivered directly to the soil. Moreover, it is a rather more straightforward task to incorporate high concentrations of anionic or nonionic surfactant in a liquid rather than a granular composition. For both of these reasons, therefore, liquid cleaning compositions have the potential to provide superior grease and oily soil removal over powdered cleaning compositions.

Nevertheless, liquid cleaning compositions suffer a number of drawbacks which can limit their consumer acceptability. Thus, they generally contain little or no detergency builder salts and consequently they tend to have poor cleaning performance on particulate soil and also lack effectiveness under varying water hardness levels. In addition, they can suffer problems relating to homogeneity, clarity, and viscosity when used by consumers. Moreover, the higher in-use surfactant concentration necessary for improved grease and soil removal causes further problems relating to extensive suds formation requiring frequent rinsing and wiping on behalf of the consumer.

A solution to the above-identified problems has involved the use of certain solvents such as those derived from aliphatic, aromatic and halogenated hydrocarbons. Their use, however, is often times undesirable for

environmental reasons due to the presence of volatile organic compounds (VOC's) therein.

Summary of the Invention:

The present invention is directed to a surface cleaning composition and process for removing oils and grease from hard surfaces. The hard surface cleaning composition contains a mixture of (a) from about 0.1 to about 35% by weight of a sugar surfactant selected from the group consisting of an alkyl polyglycoside, a polyhydroxy fatty acid amide, and mixtures thereof, and (b) from about 0.1 to about 20% by weight of an isopropylamine linear alkyl sulfonate, all weights being based on the weight of the composition.

There is also provided a process for removing soil from surfaces involving contacting the surfaces with the above-disclosed cleaning composition.

Description of the Invention:

Other than in the operating examples, or where otherwise indicated, all numbers expressing quantities of ingredients or reaction conditions used herein are to be understood as being modified in all instances by the term "about".

The sugar surfactants which may be employed in the cleaning composition of the present invention include alkyl polyglycosides and polyhydroxy fatty acid amides.

The alkyl polyglycosides which can be used in the

compositions according to the invention correspond to formula I:

$$R_1O(R_2O)_b(Z)_a \qquad (I)$$

wherein R_1 is a monovalent organic radical having from about 6 to about 30 carbon atoms; R_2 is a divalent alkylene radical having from 2 to 4 carbon atoms; Z is a saccharide residue having 5 or 6 carbon atoms; b is a number having a value from 0 to about 12; a is a number having a value from 1 to about 6. Preferred alkyl polyglycosides which can be used in the compositions according to the invention have the formula I wherein Z is a glucose residue and b is zero. Such alkyl polyglycosides are commercially available, for example, as APG®, GLUCOPON®, or PLANTAREN® surfactants from Henkel Corporation, Ambler, PA, 19002. Examples of such surfactants include but are not limited to:

1. APG® 225 Surfactant - an alkyl polyglycoside in which the alkyl group contains 8 to 10 carbon atoms and having an average degree of polymerization of 1.7.

2. GLUCOPON® 425 Surfactant - an alkyl polyglycoside in which the alkyl group contains 8 to 16 carbon atoms and having an average degree of polymerization of 1.48.

3. GLUCOPON® 625 Surfactant - an alkyl polyglycoside in which the alkyl group contains 12 to 16 carbon atoms and having an average degree of polymerization of 1.6.

4. APG® 325 Surfactant - an alkyl polyglycoside in which the alkyl group contains 9 to 11 carbon atoms and having an average degree of polymerization of 1.5.

5. GLUCOPON® 600 Surfactant - an alkyl polyglycoside in

which the alkyl group contains 12 to 16 carbon atoms and having an average degree of polymerization of 1.4.

6. PLANTAREN® 2000 Surfactant - a C_{8-16} alkyl polyglycoside in which the alkyl group contains 8 to 16 carbon atoms and having an average degree of polymerization of 1.4.

7. PLANTAREN® 1300 Surfactant - a C_{12-16} alkyl polyglycoside in which the alkyl group contains 12 to 16 carbon atoms and having an average degree of polymerization of 1.6.

Other examples include alkyl polyglycoside surfactant compositions which are comprised of mixtures of compounds of formula I wherein Z represents a moiety derived from a reducing saccharide containing 5 or 6 carbon atoms; a is a number having a value from 1 to about 6; b is zero; and R_1 is an alkyl radical having from 8 to 20 carbon atoms. The compositions are characterized in that they have increased surfactant properties and an HLB in the range of about 10 to about 16 and a non-Flory distribution of glycosides, which is comprised of a mixture of an alkyl monoglycoside and a mixture of alkyl polyglycosides having varying degrees of polymerization of 2 and higher in progressively decreasing amounts, in which the amount by weight of polyglycoside having a degree of polymerization of 2, or mixtures thereof with the polyglycoside having a degree of polymerization of 3, predominate in relation to the amount of monoglycoside, said composition having an average degree of polymerization of about 1.8 to about 3. Such compositions, also known as peaked alkyl polyglycosides, can be prepared by separation of the monoglycoside from the

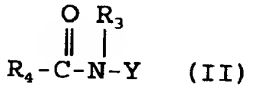
original reaction mixture of alkyl monoglycoside and alkyl polyglycosides after removal of the alcohol. This separation may be carried out by molecular distillation and normally results in the removal of about 70-95% by weight of the alkyl monoglycosides. After removal of the alkyl monoglycosides, the relative distribution of the various components, mono- and poly-glycosides, in the resulting product changes and the concentration in the product of the polyglycosides relative to the monoglycoside increases as well as the concentration of individual polyglycosides to the total, i.e. DP2 and DP3 fractions in relation to the sum of all DP fractions. Such compositions are disclosed in U.S. patent 5,266,690, the entire contents of which are incorporated herein by reference.

Other alkyl polyglycosides which can be used in the compositions according to the invention are those in which the alkyl moiety contains from 6 to 18 carbon atoms in which the average carbon chain length of the composition is from about 9 to about 14 comprising a mixture of two or more of at least binary components of alkylpolyglycosides, wherein each binary component is present in the mixture in relation to its average carbon chain length in an amount effective to provide the surfactant composition with the average carbon chain length of about 9 to about 14 and wherein at least one, or both binary components, comprise a Flory distribution of polyglycosides derived from an acid-catalyzed reaction of an alcohol containing 6-20 carbon atoms and a suitable

saccharide from which excess alcohol has been separated.

A particularly preferred alkyl polyglycoside is one wherein R_1 is a monovalent organic radical having from about 8 to about 16 carbon atoms, b is zero, and a is a number having a value of about 1.48.

The polyhydroxy fatty acid amides which can be used in the compositions and processes according to the invention are compounds of the formula II:



(II)

wherein: R_3 is H, C_1-C_4 hydrocarbyl, 2-hydroxy ethyl, 2-hydroxy propyl, or a mixture thereof, preferably C_1-C_4 alkyl, more preferably C_1 or C_2 alkyl, most preferably C_1 alkyl (i.e., methyl); and R_4 is a C_5-C_{31} hydrocarbyl moiety, preferably straight chain C_7-C_{19} alkyl or alkenyl, more preferably straight chain C_9-C_{17} alkyl or alkenyl, most preferably straight chain C_{11}-C_{19} alkyl or alkenyl, or mixture thereof; and Y is a polyhydroxyhydrocarbyl moiety having a linear hydrocarbyl chain with at least 3 hydroxyls directly connected to the chain, or an alkoxylated derivative (preferably ethoxylated or propoxylated) thereof. Y preferably will be derived from a reducing sugar in a reductive amination reaction; more preferably Y is a glycityl moiety. Suitable reducing sugars include glucose, fructose, maltose, lactose, galactose, mannose, and xylose. As raw materials, high dextrose corn syrup, high fructose corn syrup, and high maltose corn syrup can be utilized as

well as the individual sugars listed above. These corn syrups may yield a mix of sugar components for Y. It should be understood that it is by no means intended to exclude other suitable raw materials. Y preferably will be selected from the group consisting of $-CH_2-(CHOH)_n-CH_2OH$, $-CH(CH_2OH)-(CHOH)_{n-1}-CH_2OH$, $-CH_2-(CHOH)_2(CHOR')(CHOH)-CH_2OH$, where n is an integer from 3 to 5, inclusive, and R' is H or a cyclic mono- or poly- saccharide, and alkoxylated derivatives thereof. Most preferred are glycityls wherein n is 4, particularly $-CH_2-(CHOH)_4-CH_2OH$. Compounds of the formula I are also known as glucamides. Therefore, when, for example, R_1 is methyl, R_2 dodecyl; and Y is $-CH_2-(CHOH)_4-CH_2OH$, the compound in question is referred to as dodecyl N-methylglucamide.

Methods for making polyhydroxy fatty acid amides are known in the art. In general, polyhydroxy fatty acid amides can be made by reductively aminating a reducing sugar reacting with an alkyl amine to form a corresponding N-alkyl polyhydroxyamine and then reacting the N-alkyl polyhydroxyamine with a fatty aliphatic ester or triglyceride to form the N-alkyl, polyhydroxy fatty acid amide. Processes for making polyhydroxy fatty acid amides are disclosed in U.S. patent numbers 1,985,424; 2,965,576; 5,194,639; and 5,334,764 the entire contents of each of which is incorporated herein by reference.

In a particularly preferred embodiment of the present invention the sugar surfactant employed is an alkyl polyglycoside of formula I wherein R_1 is an alkyl group

having from 8 to 16 carbon atoms, b is zero, and a is a number having a value of 1.48.

Of the numerous anionic surfactants which may be employed, the present invention is directed to the use of linear alkyl sulfonates, and specifically, isopropylamine linear alkyl sulfonates. The sulfonate group, $-SO_3M$, which is attached to an alkyl, aryl or alkylaryl hydrophobe is a highly effective solubilizing group. Sulfonic acids are strong acids and their salts are relatively unaffected by pH. They are stable to both oxidation and, because of the strength of the C-S bond, also to hydrolysis. They interact moderately with the hardness ions Ca^{2+} and Mg^{2+}, significantly less so than carboxylates. Modification of the hydrophobe in sulfonate surfactants, by introduction of double bonds or ester or amide groups into the hydrocarbon chain or as substituents, yields surfactants that offer specific performance advantages.

Because the introduction of the SO_3H function is inherently inexpensive, e.g., by oleum, SO_3, SO_2, Cl_2, or $NaHSO_3$, sulfonates are heavily represented among the high-volume surfactants. While representative sulfonates include alkylarenesulfonates, short-chain lignosulfates, naphthalenesulfonates, alpha-olefinsulfonates, petroleum sulfonates, and sulfonates with ester, amide or ether linkages, the present invention is directed to the use of linear alkyl sulfonates (LAS), i.e., straight-chain alkylbenzenesulfonates. The linear alkylate thereof is an isopropylamine.

The preferred isopropylamine linear alkyl sulfonate of the present invention contains a straight alkyl chain having from about 10 to about 14 carbon atoms, most preferably from about 11 to about 12 carbon atoms, with the cation being the isopropylamine.

It has been surprisingly discovered that a synergistic cleaning effect is realized when a sugar surfactant is combined with an isopropylamine linear alkyl sulfonate, at neutral pH's, and in the absence of any organic solvents.

Thus, according to one embodiment of the present invention, there is provided a novel cleaning composition containing: (a) from about 0.1 to about 35% by weight, and preferably from about 2 to about 5% by weight, of a sugar surfactant, preferably an alkyl polyglycoside corresponding to formula I, and (b) from about 0.1 to about 20% by weight, and preferably from about 1 to about 3% by weight, of an isopropylamine linear alkyl sulfonate, preferably one with a straight alkyl chain having from about 10 to about 14 carbon atoms, all weights being based on the weight of the composition.

The above-disclosed cleaning composition are preferably used in the absence of any VOC-containing solvents, for ecotoxicological reasons. However, it should be noted that water-soluble solvents such as, for example, alcohol and glycol ethers may be employed without departing from the spirit of the invention.

The above-disclosed cleaning composition, however, is preferably diluted in water to form an aqueous surface

cleaning composition having a neutral pH ranging from about 5 to about 9, and preferably 6.5, which is free of any harmful VOC-containing solvents. In a particularly preferred embodiment, from about 1 to about 50% by weight of the above-disclosed cleaning composition is diluted in from about 50 to about 99% by weight of water to form the aqueous surface cleaning composition, all weights being based on the weight of the aqueous surface cleaning composition.

It should also be noted that the cleaning composition may also include builders and auxiliaries typically employed in such cleaning preparations. Examples of suitable builders which may be used include, but are not limited to, TSPP, STPP, silicates and citrates. Similarly, examples of suitable auxiliaries which may be used include, but are not limited to, sodium hydroxide, potassium hydroxide, TEA and MEA.

According to another embodiment of the present invention, there is provided a process for removing soil from surfaces involving contacting a surface to be cleaned with the above-disclosed aqueous cleaning composition. Surfaces which may be cleaned using the cleaning composition of the present invention include, for example, the various hard surfaces typically found in a household.

The present invention will be better understood from the example which follows, which is intended for illustrative purposes only, and are not meant to unduly limit the subject matter of the present invention in any

way.

EXAMPLE

A sample of the commercial product, Murphy's Kitchen Care Cleaner (comparative Example 1) was used as a performance standard. This product is promoted as safe to use on all kitchen surfaces, and contains no solvents, has a pH of 6.65 as is, and contains 9.8% non-volatile matter.

An aqueous all purpose cleaning composition in accordance with the present invention (Example 1 below), was formulated along with a test soil composition.

Example 1

H-165-174-1

w/w	WT %
Water	86.0
Tetrasodium EDTA (40%)	0.8
Citric Acid	2.7
Sodium Hydroxide	1.5
Isopropylamine LAS	2.0
GLUCOPON® 425-N	7.0

H1 Soil Composition

	Parts
Kerosene	100
Mineral Oil	14
10W40 Motor Oil	10
Bandy Black Clay	75
Carbon Black	1

CLEANING PERFORMANCE:

In order to determine the cleaning performance of the cleaning composition of the present invention versus that of the Murphy product, mechanical soil removal tests were conducted according to ASTM D4488 using H1 soil on white vinyl tiles as test substrates. The concentrates were tested at 1.5% actives as is in DI water, which approximates the manufacturer's recommended use dilution of 2 oz./gal for Murphy's Kitchen Care.

	% SOIL REMOVAL
MURPHY'S Kitchen Care (1.5%)	29.41
EXAMPLE 1 (1.5%)	36.82

As can be seen from the above data, the cleaning composition in accordance with the present invention, i.e, one containing a combination of an alkyl polyglycoside (GLUCOPON® 425-N) and Isopropylamine LAS is significantly more effective at cleaning oily, particulate soil, at neutral pH's, without the presence of solvents, than the Murphy's product.

What is claimed is:

1. A cleaning composition comprising:

(a) from about 0.1 to about 35% by weight of a sugar surfactant selected from the group consisting of an alkyl polyglycoside, a polyhydroxy fatty acid amide, and mixtures thereof; and

(b) from about 0.1 to about 20% by weight of an isopropylamine linear alkyl sulfonate, all weights being based on the weight of the composition.

2. The composition of claim 1 wherein the sugar surfactant is an alkyl polyglycoside corresponding to formula I:

$$R_1O(R_2O)_b(Z)_a \qquad (I)$$

wherein R_1 is a monovalent organic radical having from about 6 to about 30 carbon atoms; R_2 is a divalent alkylene radical having from 2 to 4 carbon atoms; Z is a saccharide residue having 5 or 6 carbon atoms; b is a number having a value from 0 to about 12; a is a number having a value from 1 to about 6.

3. The composition of claim 2 wherein R_1 is a monovalent organic radical having from about 8 to about 16 carbon atoms, b is zero, and a is a number having a value of about 1.48.

4. The composition of claim 2 wherein the alkyl polyglycoside is present in the composition in an amount of from about 2 to about 5% by weight, based on the weight of the composition.

5. The composition of claim 1 wherein isopropylamine

linear alkyl sulfonate has a straight alkyl chain having from about 10 to about 14 carbon atoms.

6. The composition of claim 5 wherein the isopropylamine linear alkyl sulfonate is present in the composition in an amount of from about 1 to about 3% by weight, based on the weight of the composition.

7. The composition of claim 1 wherein the composition is free of any VOC-containing solvents.

8. The composition of claim 1 having a pH ranging from about 5 to about 9.

9. A cleaning composition comprising:

(a) from about 2 to about 5% by weight of an alkyl polyglycoside corresponding to formula I:

$$R_1O(R_2O)_b(Z)_a \qquad (I)$$

wherein R_1 is a monovalent organic radical having from about 8 to about 16 carbon atoms, b is zero, and a is a number having a value of about 1.48; and

(b) from about 1 to about 3% by weight of an isopropylamine linear alkyl sulfonate having a straight alkyl chain containing from about 11 to about 12 carbon atoms, all weights being based on the weight of the composition, wherein the composition is free of any VOC-containing solvents and has a pH ranging from about 5 to about 9.

10. A process for removing soil from a surface comprising contacting the surface with a cleaning composition, the composition comprising:

(a) from about 0.1 to about 35% by weight of a sugar

surfactant selected from the group consisting of an alkyl polyglycoside, a polyhydroxy fatty acid amide, and mixtures thereof; and

(b) from about 0.1 to about 20% by weight of an isopropylamine linear alkyl sulfonate, all weights being based on the weight of the composition.

11. The process of claim 10 wherein the sugar surfactant is an alkyl polyglycoside corresponding to formula I:

$$R_1O(R_2O)_b(Z)_a \qquad (I)$$

wherein R_1 is a monovalent organic radical having from about 6 to about 30 carbon atoms; R_2 is a divalent alkylene radical having from 2 to 4 carbon atoms; Z is a saccharide residue having 5 or 6 carbon atoms; b is a number having a value from 0 to about 12; a is a number having a value from 1 to about 6.

12. The process of claim 11 wherein R_1 is a monovalent organic radical having from about 8 to about 16 carbon atoms, b is zero, and a is a number having a value of about 1.48.

13. The process of claim 11 wherein the alkyl polyglycoside is present in the composition in an amount of from about 2 to about 5% by weight, based on the weight of the composition.

14. The process of claim 10 wherein isopropylamine linear alkyl sulfonate has a straight alkyl chain having from about 10 to about 14 carbon atoms.

15. The process of claim 14 wherein the isopropylamine linear alkyl sulfonate is present in the composition in an

amount of from about 1 to about 3% by weight, based on the weight of the composition.

16. The process of claim 10 wherein the composition is free of any VOC-containing solvents.

17. The process of claim 10 wherein the composition has a pH ranging from about 5 to about 9.

18. A process for removing soil from a surface comprising contacting the surface with a cleaning composition, the composition comprising:

(a) from about 2 to about 5% by weight of an alkyl polyglycoside corresponding to formula I:

$$R_1O(R_2O)_b(Z)_a \qquad (I)$$

wherein R_1 is a monovalent organic radical having from about 8 to about 16 carbon atoms, b is zero, and a is a number having a value of about 1.48; and

(b) from about 1 to about 3% by weight of an isopropylamine linear alkyl sulfonate having a straight alkyl chain containing from about 11 to about 12 carbon atoms, all weights being based on the weight of the composition, wherein the composition is free of any VOC-containing solvents and has a pH ranging from about 5 to about 9.

19. An aqueous hard surface cleaning formulation comprising from about 1 to about 50% by weight, based on the weight of the formulation, of the cleaning composition of claim 1.

20. The formulation of claim 19 wherein the formulation is free of any VOC-containing solvents and has a pH ranging

from about 5 to about 9.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/12798

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :C11D 1/83
US CL :510 427, 470; 134/42

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 510 427, 470; 134/42

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y	US 5,476,608 A (BOYER et al.) 19 December, 1995, abstract, column 2, lines 51-53; column 3, lines 16-17, 36-37, line 54-column 4, line 45; column 7, lines 21-38; column 9, lines 27-29; column 12, lines 35-40.	1-20 — 1-20
Y	US 5,476,519 A (HASLOP et al.) 19 December 1995, abstract; column 2, lines 19-25, 43-45; column 3, line 20; column 5, lines 26-29; column 7, line 32.	1-20
A	US 5,540,866 A (ASZMAN et al.) 30 July 1996, entire document.	
A	US 5,378,388 A (PANCHERI et al.) 03 January 1995, entire document.	

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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